NOAA's National Weather Service

Basic Concepts of *Severe Storm Spotting*

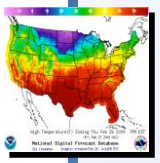
2011 – Rusty Kapela
Milwaukee/Sullivan
www.weather.gov/mkx

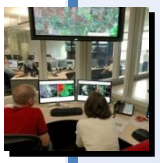
Class Agenda

- 1) Why we are here?
- 2) National Weather Service Structure & Role
- 3) Role of Spotters
- 4) Format of reports needed from spotters
- 5) Thunderstorm structure
- 6) Funnels, Tornadoes, “Fake-Nado’s”
- 7) SkyWarn Spotter page & Scary-looking Cloud Club

National Weather Service

Protecting Lives and Property





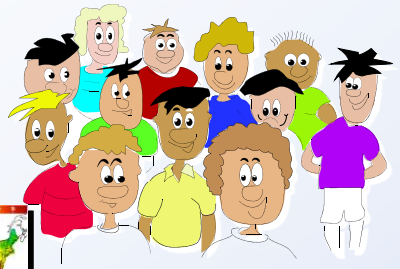
Why Are We Here?

National Weather Service

Protecting Lives and Property

National Weather Service's role

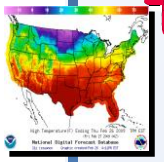
- *Issue warnings & provide training*

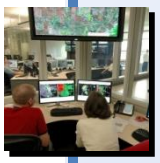


Spotter's role

- *Provide ground-truth reports and observations*

We need (more) spotters!!





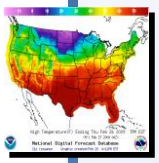
NOAA Weather Radio All Hazards

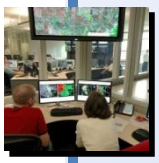
Your own personal siren - your home has a smoke alarm – does it have a weather radio?

- Receive weather information 24 hours a day
- Radio will sound a tone to alert you when a watch/warning has been issued
- Countless times, lives have been saved by NOAA Weather Radio

National Weather Service

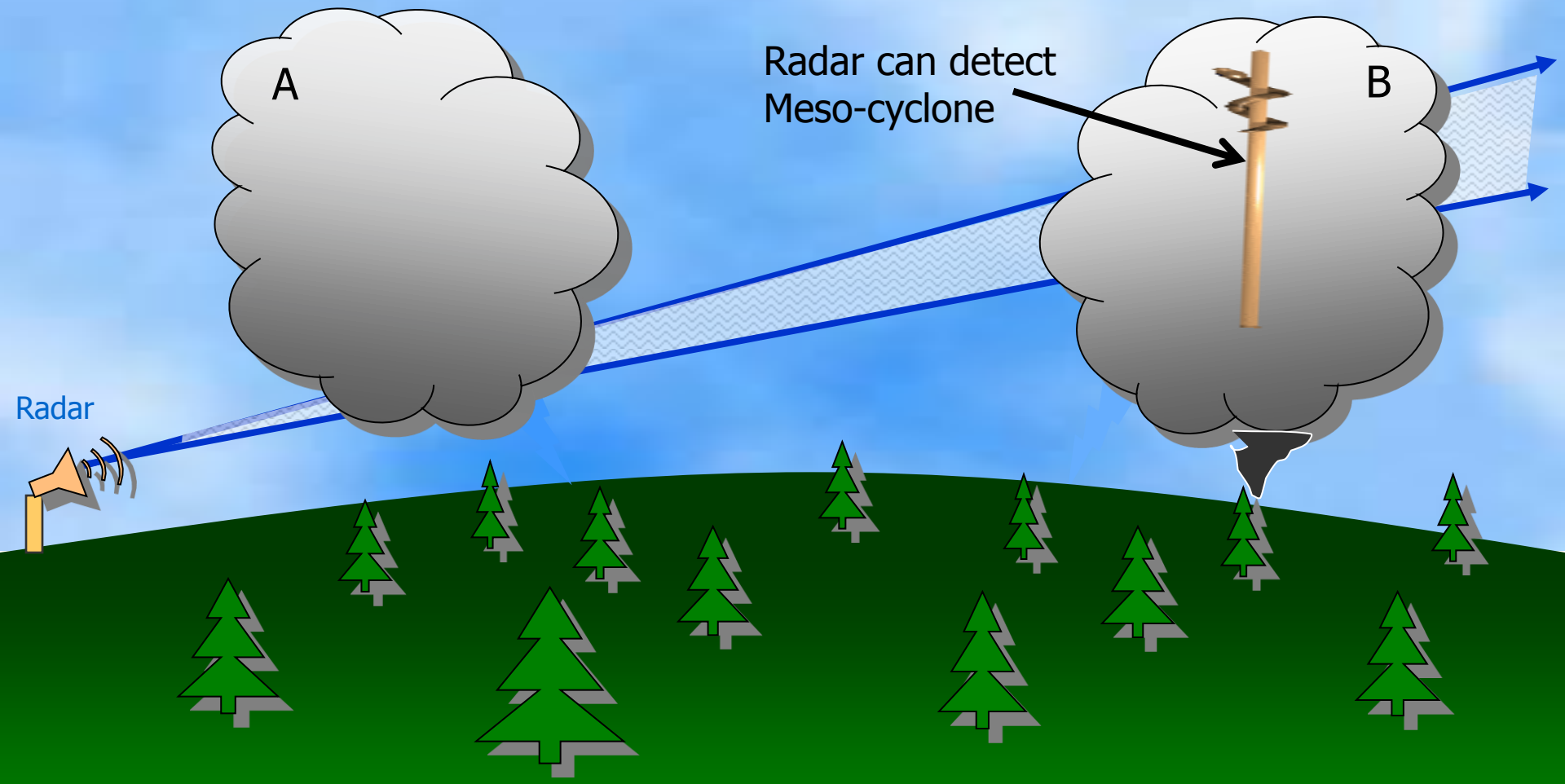
Protecting Lives and Property





NOAA Weather Radio

Radar Limitations



Radar beam cannot see lower portion of storm "B"

For Spotters – Getting Report to the NWS Office

National Weather Service

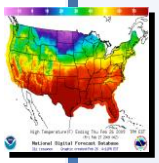
Protecting Lives and Property

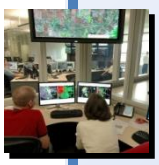
TV

E-spotter

Hams - radio

911





National Weather Service

Protecting Lives and Property

National Weather Service Weather Forecast Office

Milwaukee/Sullivan, WI

Home | Site Map | News | Organization | Search for: | NWS | All NOAA | Go

Local forecast by "City, St" or Zip Code

City, St Go

XML RSS Feeds

Current Hazards
- Watches/Warnings
- Outlooks
- Submit Report

Current Conditions
- Observations
- Radar
- Satellite
- Snow Cover
- Snowfall Analysis

Forecasts
- Forecast Discussion
- Activity Planner
- Aviation Weather
- Fire Weather
- Marine Weather
- Severe Weather
- Winter Weather
- Hurricane Center

Hydrology
- Rivers & Lakes
- Precip Estimates

Climate
- Local
- National
- Drought
- More...

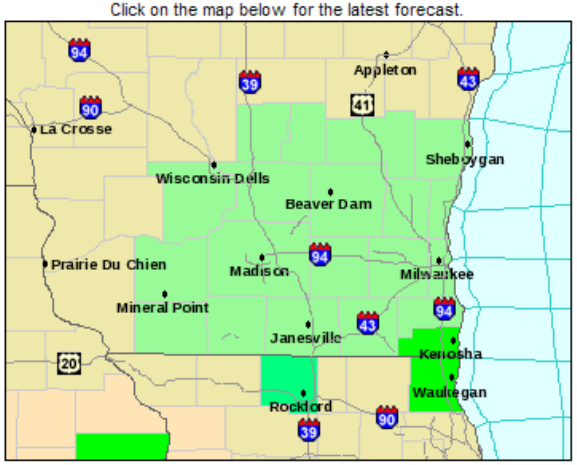
Weather Safety
- Preparedness
- Weather Radio
- StormReady
- SkyWarn

Additional Info
- Other Useful Links
- Education Resources
- Coop Observer
- Top News Archives
- Our Office

Top News of the Day
- Silent Key - For Devoted Ham Radio Operator
- Rain and Snow Sunday Night
- How Much Snow Has Fallen? (Updated 2-25-2011)
- *Additional News Headlines*

Watches & Warnings | Observations | Forecast Graphics | Rivers & Lakes | Climate | Marine

Click on the map below for the latest forecast.



Read watches, warnings & advisories | Zoom Out

- Flood Warning
- Flood Advisory
- Special Weather Statement
- Hazardous Weather Outlook
- Hydrologic Outlook
- Short Term Forecast

Last map update: Sat, Feb. 26, 2011 at 2:04:38 pm CST

Latest Conditions in Milwaukee, WI | **Choose Your Front Page City**

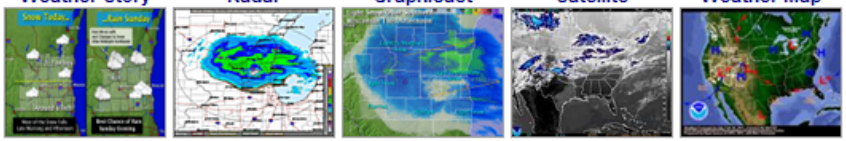
Feb 26
1:52 pm

Light Snow

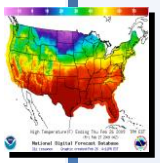
19°F
(-7°C)

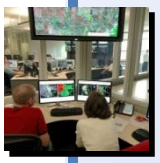
Select A City:

Weather Story | Radar | Short Term Graphicast | Satellite | Weather Map



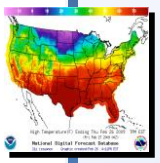
Local Historical Weather Events Search Page

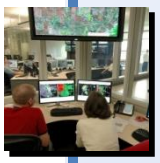




National Weather Service

Protecting Lives and Property





National Weather Service Weather Forecast Office

Milwaukee/Sullivan, WI

Home | Site Map | News | Organization | Search for: | NWS | All NOAA | Go

Local forecast by "City, St" or Zip Code

City, St Go

XML RSS Feeds

Current Hazards
Watches/Warnings
Outlooks
Submit Report

Current Conditions
Observations
Radar
Satellite
Snow Cover
Snowfall Analysis

Forecasts
Forecast Discussion
Activity Planner
Aviation Weather
Fire Weather
Marine Weather
Severe Weather
Winter Weather
Hurricane Center

Hydrology
Rivers & Lakes
Precip Estimates

Climate
Local
National
Drought
More...

Weather Safety
Preparedness
Weather Radio
StormReady
SkyWarn

Additional Info
Other Useful Links
Education Resources
Coop Observer
Top News Archives
Our Office

Spotter Page

2011 Spotter Class Schedule

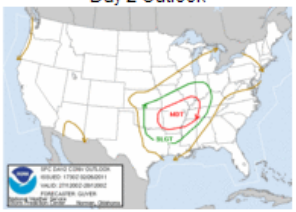
Outlook Graphics From The Storm Prediction Center - SPC

Watches

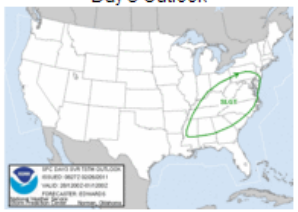
Mesoscale Discussion

Day 1 Outlook

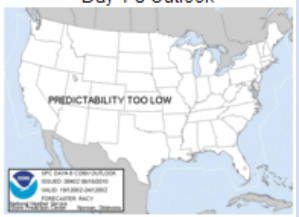
Day 2 Outlook



Day 3 Outlook



Day 4-8 Outlook



Submit a Storm Report

eSpotter - For trained and registered spotters

Severe Weather Briefing Page

Winter Weather Briefing Page

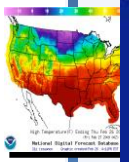
Don't Fall For The "Scary-Looking Cloud!"

View Local Storm Report Graphic

View Local Storm Report Text

On-line Report System

Register on our *eSpotter* page which can be reached from our SkyWarn Page …after you have attended a spotter class.



National Weather Service

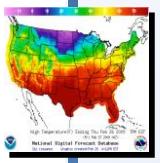
Protecting Lives and Property

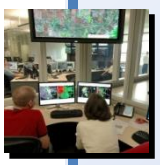
What do you Report?

- Tornadoes – rotation, also damage at ground
- Funnel Clouds (nothing going on at the ground)
- Rotating wall clouds
- Hail stones - 1 inch in diameter or larger. Size of quarters (this is warning criteria). Will take ¾ inch and 7/8 inch reports
- Thunderstorm wind gusts - 58 mph or higher (report tree/structural damage). Gusts =>58 mph generate Severe Thunderstorm Warnings
- Flooding – water over the curb or covering a road, rainfall amounts => 1 inch
- Any kind of structural or vegetative damage

National Weather Service

Protecting Lives and Property



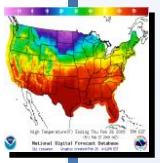


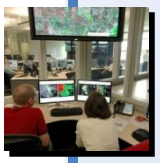
General Report Format - TLCS

- **Time** event occurred?
  - To the nearest minute
- **Location** of spotter (stationary spotter),
  - GPS coords – decimal format to the 3rd decimal
  - or referenced to the nearest city/village, to the nearest 1/10 mile (as the crow flies) and one of 16 compass directions
- **Condition** – what are you looking at or experiencing
  - what is the event?
- ***Source** – some identification, ID letters, agency, etc.

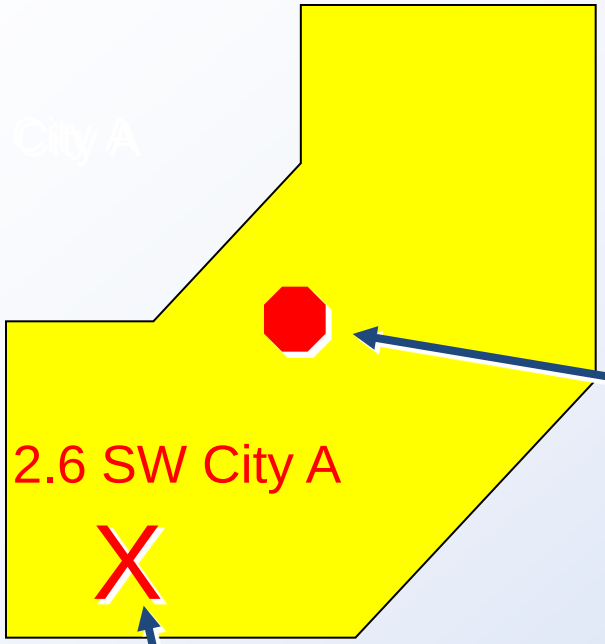
National Weather Service

Protecting Lives and Property





Reference Location



X

4.1 ENE City A

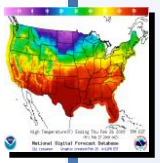
(42.845, 89.243)

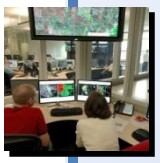
Cultural-Political center

Spotter Position

National Weather Service

Protecting Lives and Property



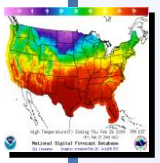


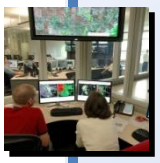
General 911 Report Format

- Always mention if the size, speed, in your report is either estimated, or physically measured.
- “Hello, I’m a trained severe weather spotter. At 4:05 pm, at a location 1.1 miles north of Saukville in Ozaukee County, I observed softball sized hail.” I’m estimating the hail size. My name is…

National Weather Service

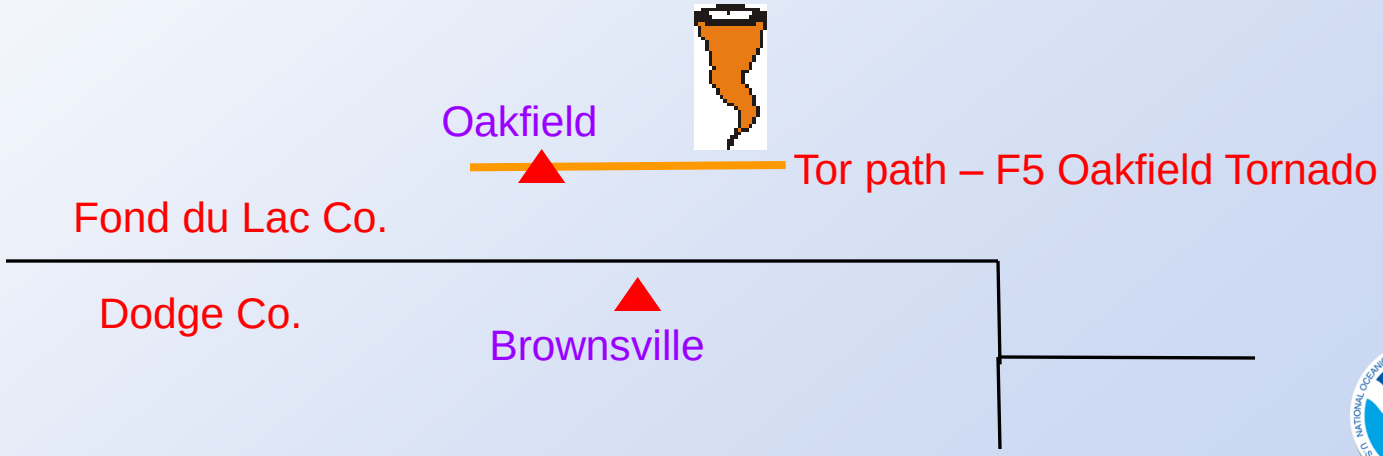
Protecting Lives and Property





General 911 Report Format

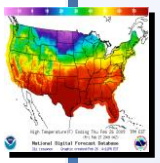
- "Hello, I'm a trained severe weather spotter. It's 630 pm. I'm located in Brownsville in Dodge County. I observed a tornado. Dodge County 911Dispatcher tells NWS that tornado is in Brownsville.

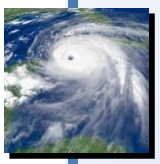


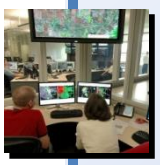
If spotter had said "Tornado is north of me in Fond du Lac County," the 911 Dispatcher would have told the NWS that the tornado was in Fond du Lac County north of Brownsville.

National Weather Service

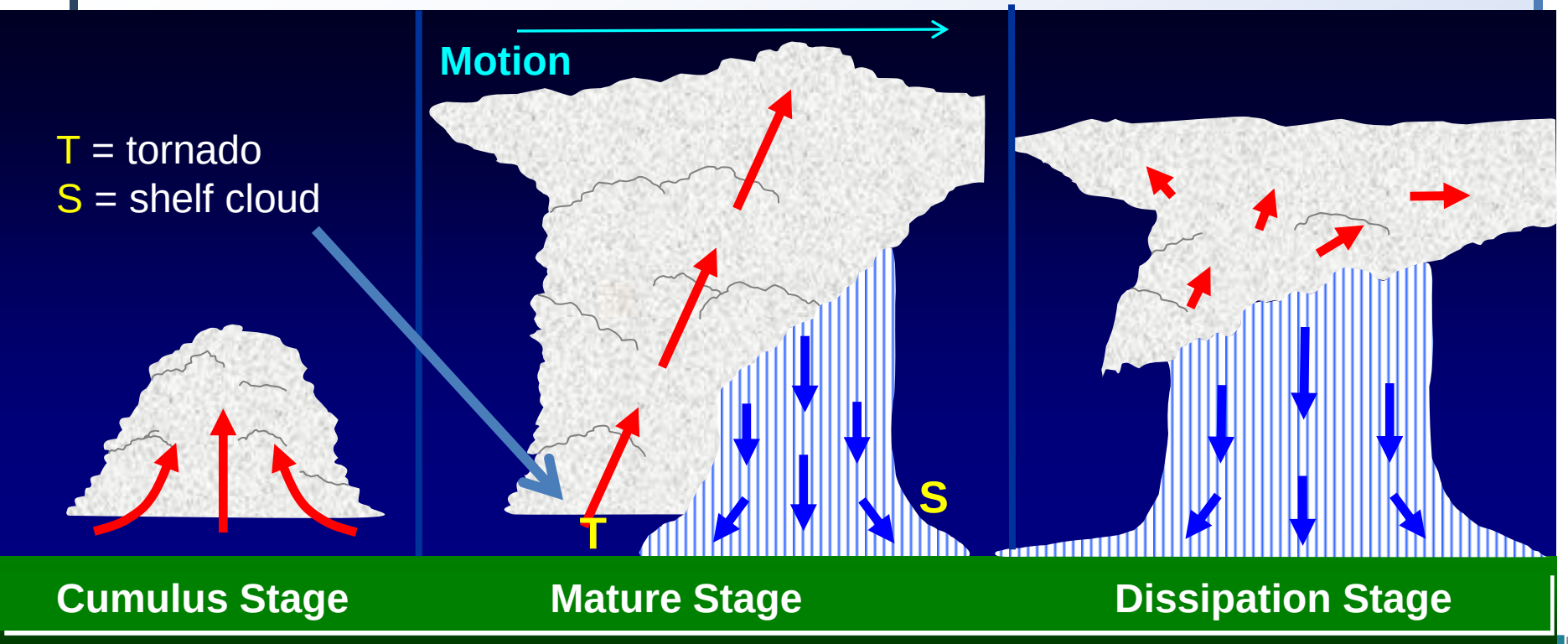
Protecting Lives and Property

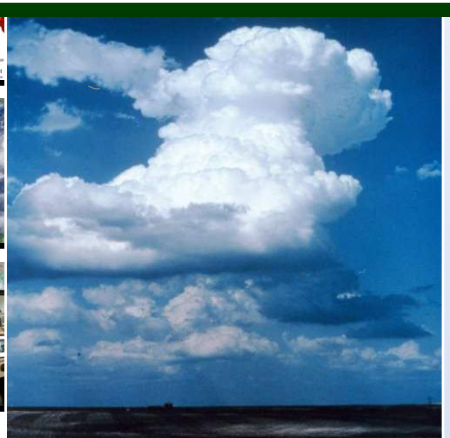






Thunderstorm Life Cycle

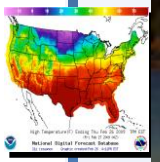


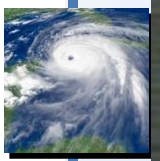


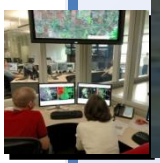
Thunderstorm Structure

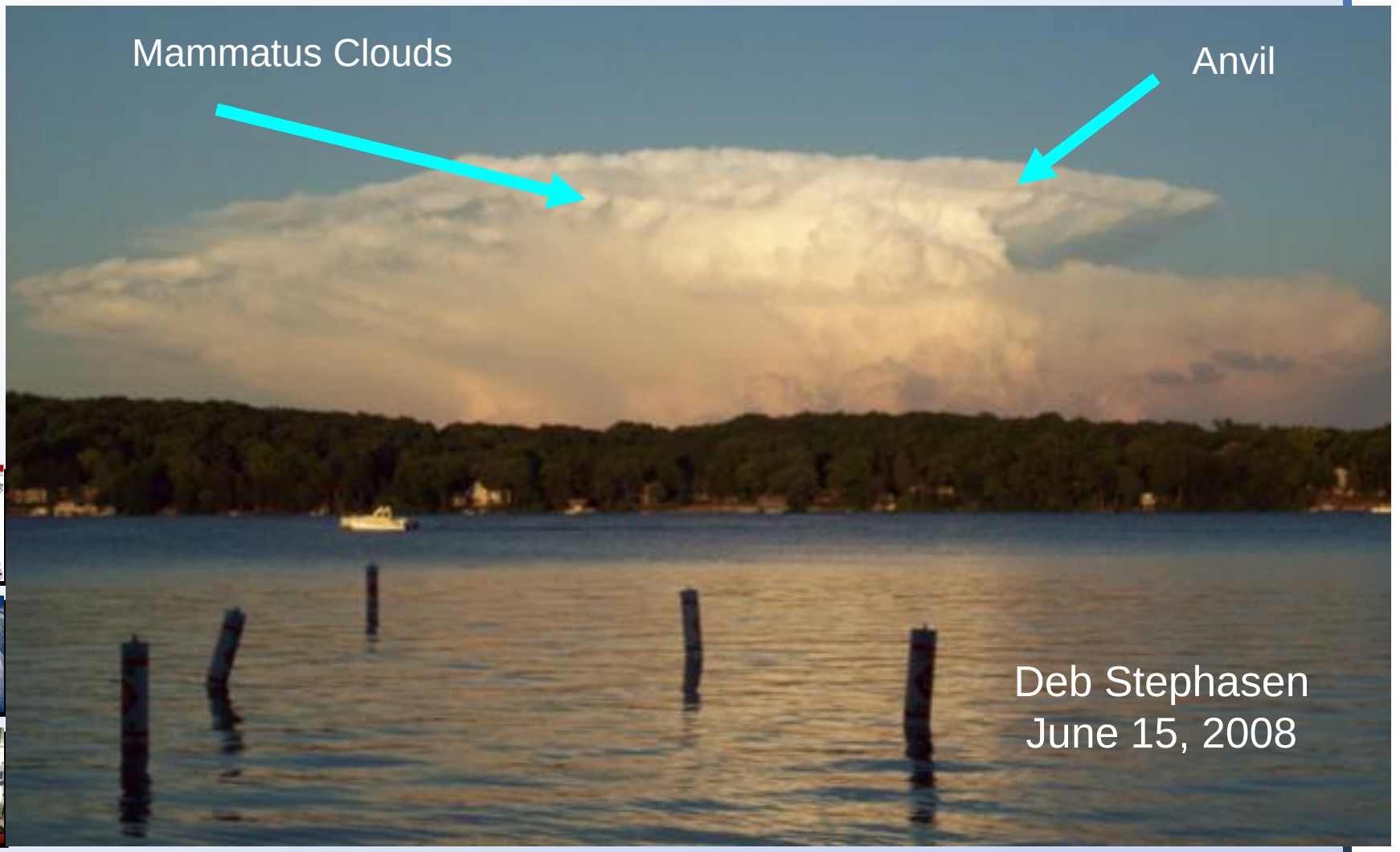
National Weather Service

Protecting Lives and Property







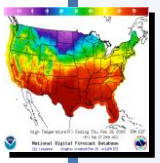


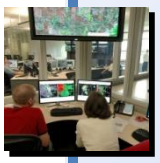
Wisconsin Tornado Stats

- Most tornadoes spin up between 3 pm and 9 pm, with 6-7 pm being the busiest.
- *Most tornadoes occur between April and September, with June being the peak month.*
- Tornadoes generally move southwest to northeast, but west to east, and northwest to southeast movements are quite possible.

National Weather Service

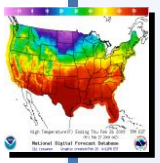
Protecting Lives and Property

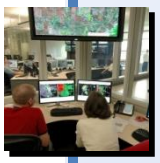




National Weather Service

Protecting Lives and Property





Wisconsin Tornado Tracks
1950-2010

Long Track

Short Track

Geographic Techniques

Data Sources: TornadoTtracks, National Weather Service; Base Map: ESRI, Wisconsin Department of Natural Resources.

NOAA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE

DEPARTMENT OF COMMERCE

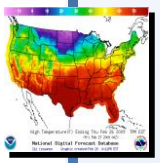
UNITED STATES OF AMERICA

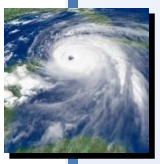
National Weather Service

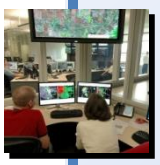
Protecting Lives and Property

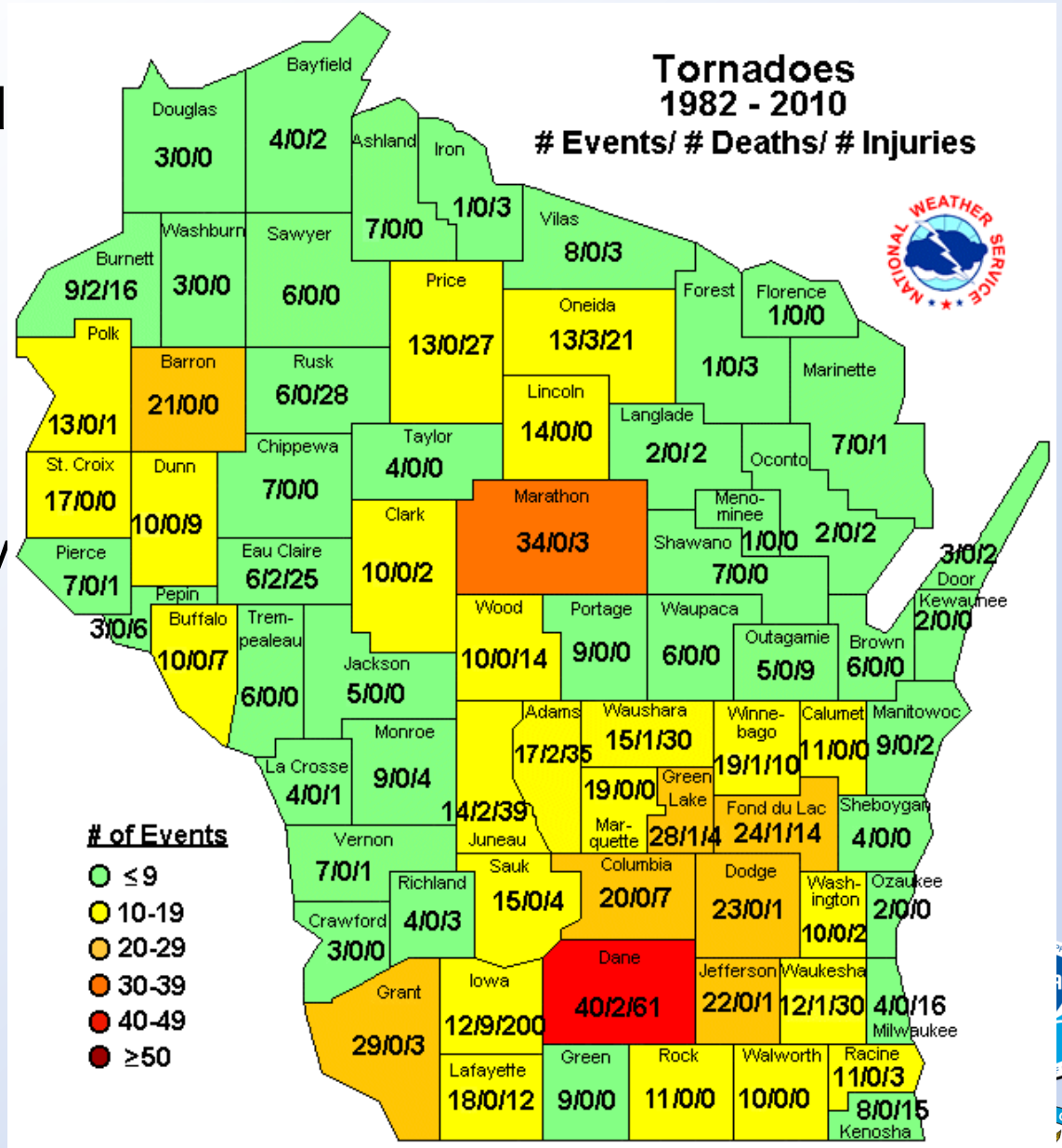
Large or populated counties typically have the higher tornado totals…

Combine Marquette and Green Lake county and you get 47 tornadoes!



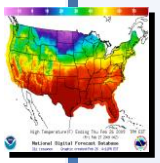


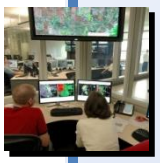




National Weather Service

Protecting Lives and Property





2010 Wisconsin Tornado Plot

MKX National Weather Service

Key

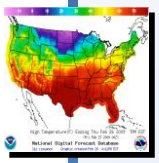
EF-0	(17)
EF-1	(24)
EF-2	(5)
EF-3	(0)
EF-4	(0)
EF-5	(0)

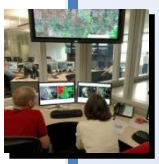
Tornado

Tornado: violently rotating column of air extending from the ground to the base of a convective cloud

National Weather Service

Protecting Lives and Property



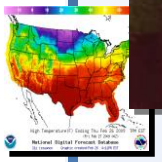


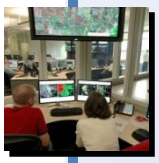
Tornado

Note: Swirling debris at ground level in both pictures below.
Condensation funnel doesn't have to "touch" ground.

National Weather Service

Protecting Lives and Property





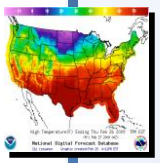
Fake Tornado

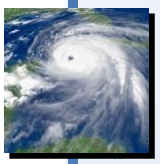
Video

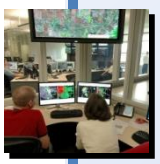
It’s not rotating & no damage!

National Weather Service

Protecting Lives and Property







Fake Tornado

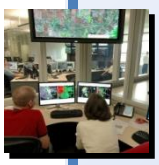
Grant County
May 31, 2008

What Do You See?

Video

Oakfield, WI - July 18, 1996

- *Reached F5 intensity*
- *30 minute duration*
- *Maximum path width of 400 yards*
- *13.3 mile path length*
- *$40.5 million in damages*
- *12 injuries*



705-735 pm… people could see it, county fair in progress, and Oakfield police officers and fire fighters recognized when they had a tornado and activated their sirens…prior to the condensation funnel reaching ground

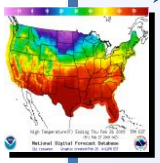
Lessons Learned

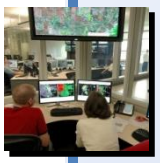
- from Oakfield Tornado

- Tornado can develop before so-called funnel cloud
- So-called funnel cloud isn't the tornado and it sits inside the invisible tornado
- Sometimes you can't tell you have a tornado until you see rotating dirt/debris spray at ground level with cloud-based rotation directly above
- Tornadoes don't touch down – they spin up below cloud base - but many condensation funnels (what most people call a funnel cloud) do develop down to the ground – giving you the false impression of a "touch down"

National Weather Service

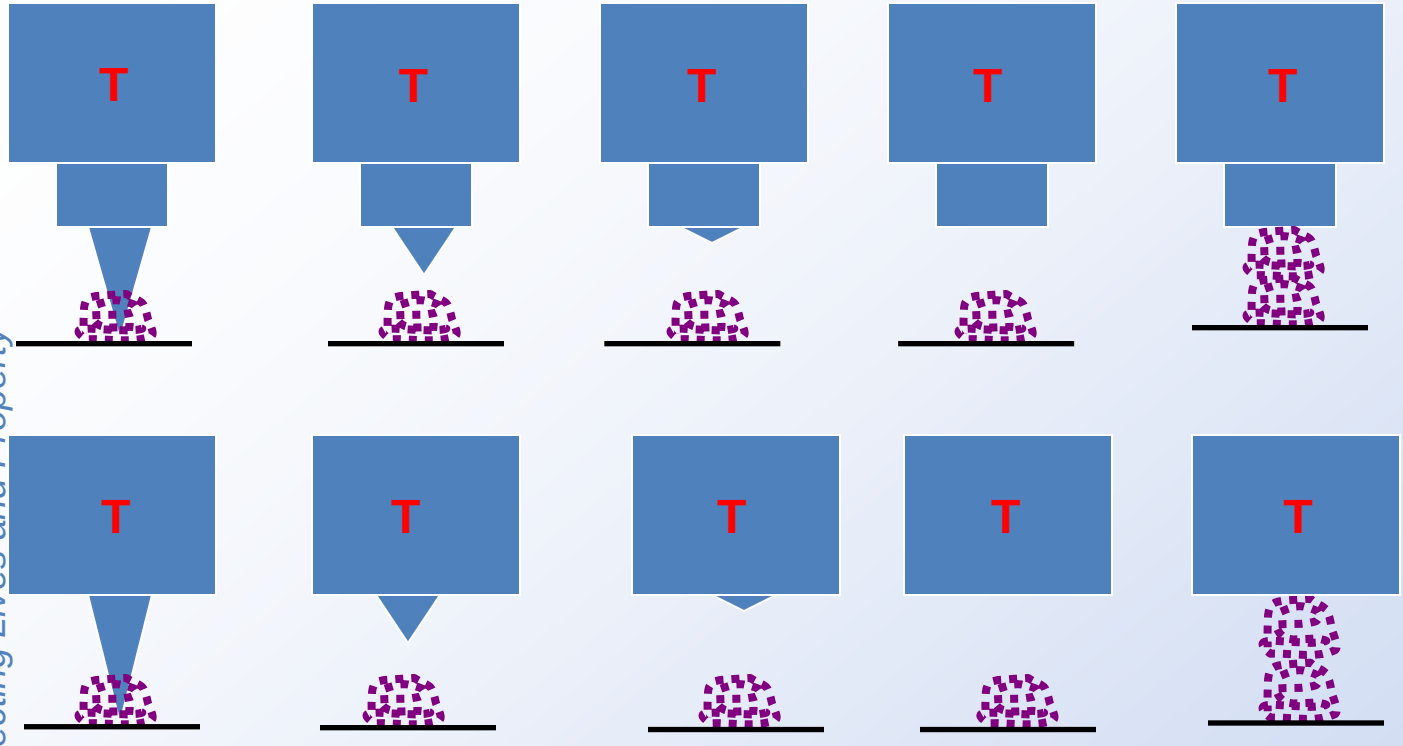
Protecting Lives and Property

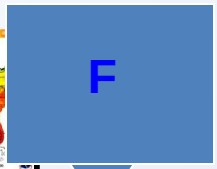




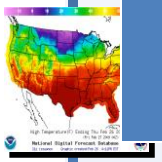
National Weather Service

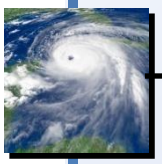
Protecting Lives and Property

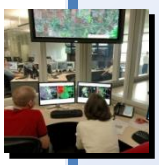




ground





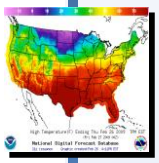


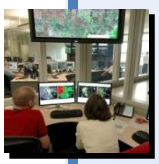
First Two Rows = all are Tornado cases
Big Square = Thunderstorm Cloud
Little Square = Rotating Wall Cloud
Purple Dots = Rotating Debris/Dirt Spray/Swirl
Triangle = Condensation Funnel (must be rotating) and Purple Dots present
Last Row = Funnel Cloud (if no Purple Dots present and feature is rotating))

Tornado – condensation funnel
Extends from cloud base to ground, also debris spray at ground level

National Wea

Protecting Lives



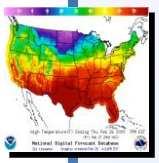


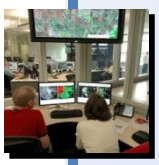
Tornado – rotation in condensation funnel and debris spray at ground level

National Weather Service

Protecting Live

Tornado – note condensation funnel and debris spray at ground



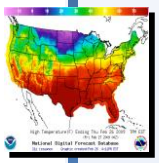


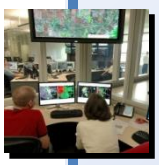
Tornado – note debris spray at ground, and we assume there was cloud base rotation

National Weather Service

Protecting Lives

Tornado – note condensation funnel and debris spray at ground, but no rotating wall cloud visible in picture

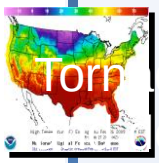




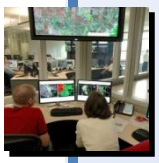
National Weather Service

Protecting Lives a

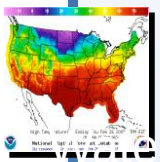
Tornado – note condensation funnel and debris spray at ground

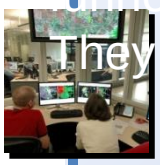


Torn do – note condensation funnel
ebris spray at ground



Tornado – note debris spray at ground and some extension upward. We assume there was cloud-base rotation



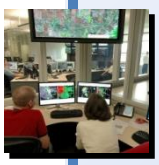


Waterspout – a tornado over water – note water spray defines Tornadic circulation and condensation funnel not in contact with water surface. They are dangerous – it's a tornado!

Funnel Clouds

- Funnel Clouds, by strict definition, do **NOT** come in contact with the ground, nor do they create a rotating dust/debris cloud at ground-level
- A true *funnel cloud* will ALWAYS be rotating

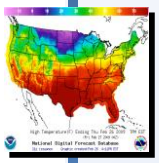
Doug Raflik

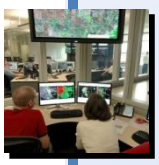


Funnel Cloud

National Weather Service

Protecting Lives and Property



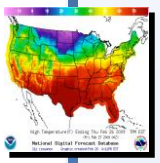


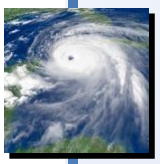
Scary-Looking Cloud Club

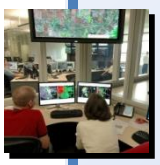
National Weather Service

Protecting Lives and Property

Click on “SkyWarn” link







Scary-Looking Cloud Club

National Weather Service Weather Forecast Office

Milwaukee/Sullivan, WI

Home | Site Map | News | Organization | Search for: | NWS | All NOAA | Go

Local forecast by "City, St" or Zip Code

City, St | Go

XML RSS Feeds

Current Conditions
Observations
Radar
Satellite
Observed Precip

Forecasts
Forecast Discussion
Activity Planner
Aviation Weather
Fire Weather
Marine Weather
Severe Weather
Winter Weather
Hurricane Center

Hydrology
Rivers & Lakes

Climate
Local
National
Drought
More...

Weather Safety
Preparedness
Weather Radio
StormReady
SkyWarn

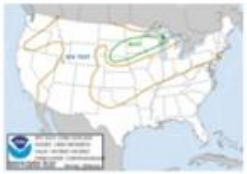
Additional Info
Other Useful Links
Education Resources
Coop Observer
Top News Archives
Our Office

Spotter Page

2010 Spotter Class Schedule

...phics From The Storm Prediction Center - SPC

...atches | Mesoscale Discussion | Day 1 Outlook



Day 2 Outlook | Day 3 Outlook | Day 4-8 Outlook

Submit a Storm Report

eSpotter - For trained and registered spotters

Severe Weather Briefing Page

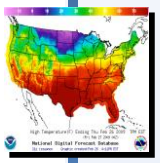
Don't Fall For The "Scary-Looking Cloud!"

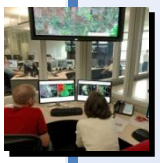
View Local Storm Report Graphic

Click on "Scary-Looking Cloud!"

National Weather Service

Protecting Lives & Property



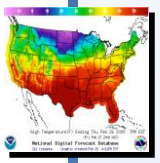


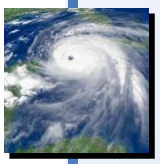
SLC Club

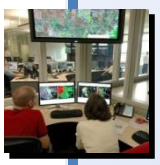
National Weather Service

Protecting Lives and Property

Read entire story. Some embedded links have more info. There are 5 pages of SLC pictures







Local forecast by "City, St" or Zip Code

City, St Go

XML RSS Feeds

- Current Hazards
  - Watches/Warnings
  - Outlooks
  - Submit Report
- Current Conditions
  - Observations
  - Radar
  - Satellite
  - Observed Precip
- Forecasts
  - Forecast Discussion
  - Activity Planner
  - Aviation Weather
  - Fire Weather
  - Marine Weather
  - Severe Weather
  - Winter Weather
  - Hurricane Center
- Hydrology
  - Rivers & Lakes
- Climate
  - Local
  - National
  - Drought
  - More...
- Weather Safety
  - Preparedness
  - Weather Radio
  - StormReady
  - SkyWarn
- Additional Info
  - Other Useful Links
  - Education Resources
  - Coop Observer
  - Top News Archives
  - Our Office
- Contact Us
  - Contact Info
  - Feedback

Welcome To The "Scary-Looking Cloud" Club

To join, all you have to do is email rusty.kapela@noaa.gov and attach your favorite picture of a "Scary Looking Cloud," or SLC for short. Now is the time to join the SLC Club!

Due to an overwhelming response, we can only post the best ones. Hope you understand. Any picture you send to me automatically becomes part of the public domain - for free use by anyone. I will give you credit, as seen in the pictures below.

It would be greatly appreciated if you could reduce the size of your digital picture to something in the range of 500 x 600 prior to emailing it to me.

Scary-looking clouds are cloud fragments that briefly resemble funnel clouds or tornadoes and hang low at the base of the parent clouds. Due to hills and trees blocking your field of view, they may even appear to touch the ground. These kinds of clouds look **scary** to some people who might call them in as funnel clouds, or even tornadoes, to the 911 Dispatchers of the local Sheriff Department. This results in false funnel cloud or false tornado reports being relayed to the National Weather Service.

Most false tornado and false funnel cloud reports are associated with **shelf clouds**. Shelf clouds are a low-hanging, horizontal cloud feature attached to the front side of **lines of storms or even a single storm**. Usually there isn't any persistent rotation on a vertical axis within shelf clouds or within individual cloud fragments that extend downward from the shelf cloud, therefore they are just another scaryfal-looking cloud. Shelf clouds often resemble snow plows, big waves, or tsunamis, and can be very scary-looking since they are usually low-hanging. Sometimes they may found only a couple hundred feet above the ground. There are two other phenomena that might resemble tornadoes or funnel clouds, but are not: 1) dark rain shafts, or narrow colums of heavy rain, and 2) the white color of a hail shaft, a column of hail extending from the ground to the cloud base, may generate a light-dark contrast with surrounding rain, resulting in what might appear to be a funnel cloud or a tornado to the untrained eye.

Scary-looking clouds are the result of abundant moisture in the atmosphere and sufficient rising motion in the column of air between the ground and the predominate cloud base. The invisible water vapor quickly condenses into a visible cloud fragment which is subsequently raised up to the shelf cloud base.

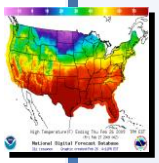
Cloud fragments within the shelf cloud are rising into the thunderstorm base - this rising motion is referred to as an "updraft" in lines of storms. Shelf clouds can extend horizontally for many miles in length and are your visual indication that the downdraft portion of the thunderstorm line is approaching (behind the shelf cloud, relative to the storm motion). In lines of thunderstorms the updraft is on the forward side and the downdraft is on the backside of the line. The downdraft consists of three things: gusty winds, rain, and possibly hail. Tornadoes rarely develop under or near the shelf cloud because of the lack of persistent, organized, rotation on a vertical axis on the front side of the line of storms. The strongest of downdrafts are called "downbursts" which can produce hurricane-force, straight-line winds of 75 mph to over 100 mph at ground-level, torrential rains, and near-zero visibilities.

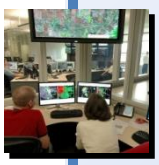
Generally, if the shelf cloud and storm are rapidly moving toward you then the gusty winds in the downdraft tend to be stronger. The shelf cloud develops in response to the rain-cooled air associated with the downdraft under-cutting and rapidly lifting up the lighter, warm, moist air found ahead of the line of storms. In Jerry's picture below, the scary-looking, funnel-shaped cloud was not rotating. Therefore it wasn't a true tornado. Actual tornadoes and funnel clouds rotate! If the scary-looking cloud you are looking at is not rotating, it's not a funnel cloud or a tornado, even if it looks like it's touching the ground or almost touching the ground!

Scary-Looking Clouds!

National Weather Service

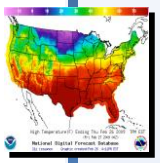
Prot

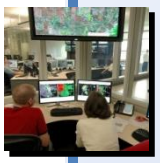




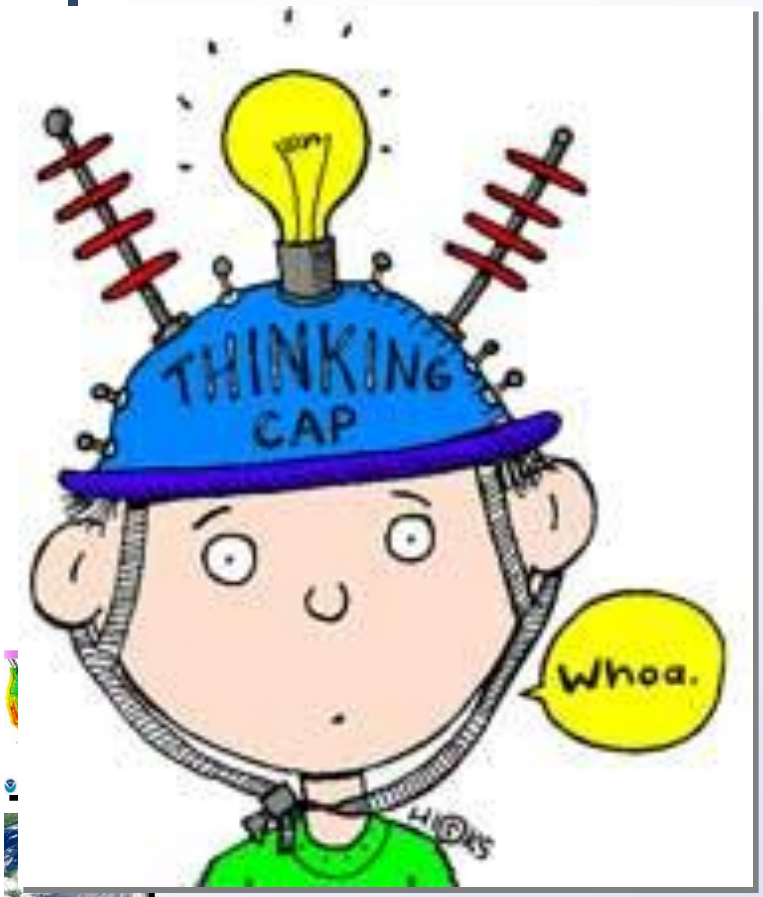
Caution

- "Better safe than sorry" means "not passing on a false tornado or funnel cloud report.
- Human weakness – adrenaline & excitement can undo months of training.
- You know enough to be dangerous – if you're not sure….don't call in your report!

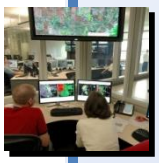




Quiz Time!


THINKING
CAP
Whoa.

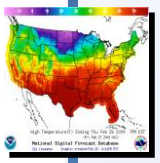

?
Jerry Verveka/MASA
July 7, 2008
In Briggsville, Marquette Co.
Looking south

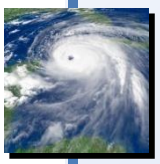


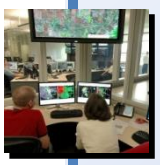
Tornado or funnel cloud?

National Weather Service

Protecting Lives and Property



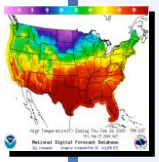


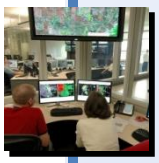


Tornado, Funnel or SLC?

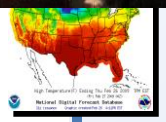
Natio

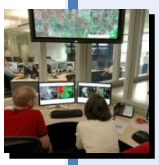
Protec





Tornado, Funnel or SLC?





End of Basic Class!!!

National Weather Service

Protecting Lives and Property